FINAL REPORT

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**EVALUATION OF AMMONIA HOLDING CHARACTERISTICS OF
ZEOLITE AND ITS EFFECTIVENESS IN MANURE ODOUR CONTROL**

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APPENDIX A

Ammonia Holding Characteristics of Zeolite and its Effectiveness in Manure Odour Control

This work was conducted as a result of scientific interest and at the request of Mountain Minerals Co. Ltd. Dr. C. Chang was the scientist responsible for the experiment.

The soil used in all three tests was sandy loam from Iron Springs, Alberta. The zeolite used in the tests was supplied by L.E.W. Hogg and came from the Z-1 Zeolite Quarry in Cache Creek, British Columbia. Three separate tests were performed. Test One involved a granular form of zeolite and Test Two involved a powdered form of zeolite. Test Three utilized standard top soil.

In each of the three tests, 500g of the soil and 300g of bovine manure were placed in two separate square aluminum baking pans and evenly spread out across the bottom of the pan. Zeolite or standard soil was sprinkled evenly on the manure and moistened with deionized water from a spray bottle. Three repetitions of five different ratios of manure to zeolite or soil were conducted (Table 1).

Table 1 Ratio of Manure to Zeolite	
Treatment #	
1	M:S No zeolite
2	10:1 In weight
3	7.5:1 In weight
4	5:1 In weight
5	3:1 In weight

The two baking pans containing the soil and manure-zeolite or manure-soil mixture were then placed into an aluminum drying tray and sealed using another aluminum drying tray and duct tape. The test was then left to incubate at room temperature for eight days.

After incubation, the two pans were first stirred using a stainless steel spatula to obtain a representative sample before being placed into a 500ml glass bottle with screw top to await analysis.

Chemical Analysis

Soil (5g) and manure (1g) samples were extracted using 25ml of 2N KCl and mixed for one hour. The solutions were filtered through Whatman #1 filter paper into 100ml glass bottles. The soil (5ml) and manure 1ml) filtrate was diluted in a volume of 100ml of 2N KCl. Ammonia concentration in the filtrate was measured using the procedure of Kemper and Zweers 1986.

Results and Discussion

The results of these experiments demonstrate that zeolite effectively sequesters ammonia and prevents its release into the atmosphere. The absorption of ammonia into the sandy loam soil trap was significantly reduced in the presence of both the granular and powdered zeolite (Figures 1). This observation was supported by the fact that a larger portion of the ammonia remained in the manure that was mixed with zeolite. The analysis of the manure mixture demonstrates a significant improvement in ammonia holding characteristics when the zeolite coverings are compared to the soil covering. There are only minor differences in the ammonia adsorbency/absorbency between the granular and powdered zeolite treatments (Figure 1) due to the length of time of the tests. The powdered zeolite reacts faster than the granular zeolite. This observation agrees with Bernal and Lopez-Real 1993. Figure 1 was created using the means of three repetitions in each treatment.

Conclusion

The results clearly show there is an advantage in the use of zeolite to control bovine manure odour. The effect of the zeolite improved as greater amounts were applied. It is considered that the zeolites adsorb/absorb other volatiles such as amines and hydrogen sulfite that are more noxious than ammonia. This controlled experiment verifies the efficacy of zeolite at odour control.

References

Natural zeolites and sepiolite as ammonia and ammonia absorbent materials. MP Bernal, JM Lopez-Real - Bioresource Technology, 1993 – Elsevier

Figure 1: Ammonia Retained in the Manure Mixture Due to Zeolite Additions